

1st Assignment – First steps within the Matlab environment

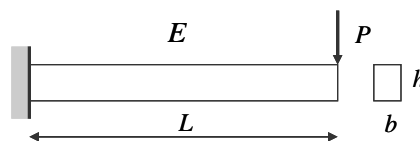
Task 1: Getting warm with Matlab: Matrix operations

Matrix **A** is given as: **A** = [1 2 3; 4 5 6; 7 8 10]

- Retain the diagonal elements of **A** and save them into vector **d**.
- Create an identity matrix with same dimensions as **A**.
- Modify matrix **A**, so that all diagonal elements are equal to one.

Task 2: Elementary Data Analysis – Descriptive statistics

Consider the timber cantilever beam shown in the figure below.



Using the Bernoulli equation, the displacement at the free end is given by

$$u = \frac{PL^3}{3EI}$$

where E is the Young's modulus of the material, P is the applied loading, L is the length of the beam, $b \times h$ are the dimensions of the cross-section and $I = bh^3/12$ is the moment of inertia. The length of the beam is $L = 4$ m, the dimensions of the cross-section are $b = 15$ cm, $h = 25$ cm and the applied load $P = 2000$ N. The properties of the timber material are determined through a series of tests with results as given in Table 1.

Table 1. Tensile strength and Young's modulus from tests on timber specimens (provided by Lehrstuhl für Holzbau und Baukonstruktion, TUM).

Specimen #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Tensile strength [N/mm ²]	37.1	36.9	40.5	46.8	37.6	30.0	29.0	27.5	30.7	43.9	29.2	28.7	18.3	34.3	35.0	58.0	20.9
Young's modulus [N/mm ²]	10237	6951	12242	20814	18815	13005	9886	8155	11437	11718	8348	9368	10123	11677	10770	9993	8808
Specimen #	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Tensile strength [N/mm ²]	26.8	18.4	34.0	28.4	35.2	27.1	38.0	28.0	30.3	54.9	55.4	32.8	39.5	19.3	54.2	23.1	50.3
Young's modulus [N/mm ²]	11598	9530	10669	12648	11765	12076	12950	8799	7841	12568	11830	11676	9576	8364	12574	6611	12399
Specimen #	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Tensile strength [N/mm ²]	66.5	32.7	35.7	36.2	26.4	54.8	27.5	25.3	48.3	47.7	52.9	29.9	42.4	24.8	28.9	26.0	
Young's modulus [N/mm ²]	14024	12176	10796	11384	10330	12723	12608	7956	12886	10771	11158	9223	10457	8278	8587	9928	

Create a Matlab program (*.m file) that computes the statistics of the displacement of the beam, based on the results of the material tests. The program should perform the following tasks:

- Import the data stored in the given Timber.dat file using the *load* command.
- Extract the measured values of the Young's modulus and store them in a vector.
- Compute the corresponding values of the displacements.
- Compute the sample mean, sample median and sample standard deviation of the displacements. For the standard deviation, use 1) the formula as square root of the sample variance and 2) the Matlab build-in function "std".
- What is the range of the Young's modulus?
- Calculate the quantiles of the displacements for the cumulative probabilities 0.025, 0.25, 0.5, 0.75, and 0.975.
- Use the function "whos" to print all variables currently saved in the workspace into the command window.
- Save the workspace into a .mat file.